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Progress Report

July 1 to December 31, 1952

on

REFRIGERATION AND MISCELLANEOUS EQUIPMENT

by

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for

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NBS

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Progress Report

July 1 to December 31, 1952

REFRIGERATION AND MISCELLANEOUS EQUIPMENT

Tent Heater Fan Samples

Two different types of propeller fans were tested to determine relative efficiency, power input, and capacity. Both specimens were intended for use on a gasoline-fired tent heater to circulate the heated air. One specimen was a Torrington fan, the other a Herman-Nelson fan. Considerable difficulty was experienced in measuring power input since the fan was mounted on the engine shaft and the engine body was located directly in the fan inlet. This made it necessary to use an actual engine body with a shaft extending through the engine to the dynamometer shaft. Fan specimen T (Torrington) on the hot run with open duct moved 2160 cfm (corrected to standard air) with 1.53 total horsepower input (measured at engine coupling) and on the cold run with open duct moved 2190 cfm with 1.58 horsepower input; and fan specimen S (Herman-Nelson) at corresponding conditions moved 2035 cfm with 1.16 horsepower input and 2100 cfm with 1.23 horsepower input. Fan speeds were held at 3450 rpm. These tests were repeated using a different tent heater, manufactured by Silent-Glow. The results obtained could not be correlated with the results obtained with the Herman-Nelson tent heater, and it is believed that this might be due to different internal construction of the two heaters, and the positioning of the fans within the shroud.

Progress Report

July 1 to December 31, 1932

AERODYNAMICAL AND MISCELLANEOUS EQUIPMENT

Test Heater Fan Samples

Two different types of propeller fans were tested to determine relative efficiency, power input, and capacity. Both specimens were intended for use on a gasoline-fired test heater to circulate the heated air. One specimen was a Torrington fan, the other a German-Nelson fan. Considerable difficulty was experienced in measuring power input since the fan was mounted on the engine shaft and the engine body was located directly in the fan inlet. This made it necessary to use an actual engine body with a shaft extending through the engine to the dynamometer shaft. Fan specimen Y (Torrington) on the hot run with open duct moved 2160 cfm (corrected to standard air) with 1.59 total horsepower input (measured at engine coupling) and on the cold run with open duct moved 2120 cfm with 1.39 horsepower input; and fan specimen G (German-Nelson) at corresponding conditions moved 2035 cfm with 1.16 horsepower input and 2100 cfm with 1.59 horsepower input. Fan speeds were held at 3450 rpm. These tests were repeated using a different test heater, manufactured by Stant-Glow. The results obtained could not be correlated with the results obtained with the German-Nelson test heater, and it is believed that this might be due to different internal construction of the two heaters, and the positioning of the fans within the shroud.

Fuel Metering

Kerr Warehouse

The tests on the warehouse manufactured by A. H. Kerr Company were completed. For the first test to determine the heat transmission coefficient, all cracks between panels, door, etc. and other openings were sealed with masking tape and shellac. The "U-Factor" for this test was 67.2 Btu/hr (°F temperature difference). For the second test, all of this sealing material was removed and the heat transmission coefficient was 84.3 Btu/hr (°F temperature difference).

Brown Warehouse

Tests were made of a nominal 150-cu ft warehouse to determine its overall heat transmission coefficient. This warehouse was manufactured by the Brown Trailer Company, Spokane, Washington. It was of the non-demountable, portable type, and was provided with an opening for the refrigerating unit. An access door was provided on the opposite side of the refrigerating unit opening. The heat transmission coefficient of this warehouse was found to be 27.1 Btu/hr per degree temperature difference. The opening of the refrigerating unit was blanked off for this test with a panel of 3/4-inch plywood.

Thermo-King Plug-type Refrigerating Unit

Operational tests were made of a model Q-15-E Thermo-King plug-type, electric motor-driven refrigerating unit for use with portable or demountable warehouses. The unit was manufactured by the U. S. Thermo Control Company of Minneapolis, Minnesota. Two inter-connected hermetic motor-compressor units were employed to furnish capacity range. The observed capacity with both compressors in operation at 70°F ambient temperature was 2400 Btu/hr with air entering the evaporator at a

Kerr Warehouse

The tests on the warehouse manufactured by A. H. Kerr Company were completed. For the first test to determine the best transmission coefficient, all cracks between panels, door, etc. and other openings were sealed with masking tape and sealing. The "U-Factor" for this test was 0?.8 Btu/hr (°F temperature difference). For the second test, all of this sealing material was removed and the heat transmission coefficient was 0?.3 Btu/hr (°F temperature difference).

Brown Warehouse

Tests were made of a nominal 1?0-cu ft warehouse to determine its overall heat transmission coefficient. This warehouse was manufactured by the Brown Trailer Company, Spokane, Washington. It was of the non-demountable, portable type, and was provided with an opening for the refrigerating unit. An access door was provided on the opposite side of the refrigerating unit opening. The heat transmission coefficient of this warehouse was found to be 3?.1 Btu/hr per degree temperature difference. The opening of the refrigerating unit was blanked off for this test with a panel of 3/4-inch plywood.

Thermo-King Fins-type Refrigerating Unit

Operational tests were made of a model 9-1?-K Thermo-King plug-type, electric motor-driven refrigerating unit for use with portable or demountable warehouses. The unit was manufactured by the U. S. Thermo Control Company of Minneapolis, Minnesota. Two later-connected hermetic motor-compressor units were employed to furnish capacity range. The observed capacity with both compressors in operation at ?0°F ambient temperature was 8?00 Btu/hr with air entering the evaporator at a

temperature of -19.5°F, 4300 Btu/hr at 0°F, and 9700 Btu/hr at 35°F. Tests were also made at ambient temperatures of 90°F, 110°F, and 125°F, with air entering the evaporator ranging from 0°F to 35°F. Capacities observed during this second series of tests ranged between 2900 and 5800 Btu/hr.

Tests have commenced on the Thermo-King and Carrier 1/3-ton refrigerating units to determine capacity and operating characteristics for speeds ranging from 25 percent below to 25 percent above the rated speed of the units.

26-cu ft Refrigerator

Tests were made on a 26-cu ft portable, chest-type freezer manufactured by Emery-Thompson Machine and Supply Company, New York, N. Y. The freezer was equipped with a 1-HP Copeland mechanically-sealed hermetic condensing unit. Tests were made to observe the lowest box temperatures obtained at ambient temperatures of 70°F, 95°F, and 120°F. In addition, observations were made of the "pull-down" characteristics of the refrigerator at 70°F ambient temperature. The lowest box temperatures obtained were -38.2°F, -22.1°F, and -6.8°F, at ambients of 70°F, 95°F, and 120°F, respectively. At an ambient temperature of 70°F, the pull-down time from 70°F to 0°F was 50 minutes, to -20°F was 2 hours, to -30°F was 3-1/2 hours, and -38°F was 9-1/2 hours.

Drifreez Refrigerant Dehydrator

Tests have been completed to determine resistance to vibration of a refrigerant dehydrator known as "Drifreez", manufactured by the Berna Corporation of Richmond Hill, New York. The dehydrator was operated for

more than 100 hours during a vibration test at 3300 cycles/min. and an amplitude of 0.0375 inch. No breakdown of the test samples was evident at the conclusion of this test.

Tests to determine the rate of moisture removal, and drying ability, and total moisture removal capacity of the 3/8 in. line size dehydrator have been completed. This size dehydrator employs approximately 43.3 grams of calcium carbide as the desiccant. This size appears to be able to remove approximately 20 grams of water from liquid CH_3Cl refrigerant with a final system wetness of about 60 parts per million. An end dryness of less than 6 ppm under ideal conditions appears to be possible with this desiccant. The rate of drying appears to be slow, the sample tested required 5 days to remove 2g grams of water from the test system. The method employed to determine moisture content of the refrigeration system was the Electrolytic method, as developed by the Chemistry Division of the National Bureau of Standards. The tests were made with the cooperation of the Chemistry Division. Initially, difficulties were encountered in adapting this moisture measuring method to a refrigerating system, and this accounted for some delay in the testing. Moisture determinations employing the Phosphorous Pentoxide method were made by the Chemistry Division for comparison with the Electrolytic method.

Tests were begun to determine the possible explosion hazards of this dehydrator, as acetylene gas is formed by the reaction of water with the desiccant. These tests are about completed.

Refrigerator Doors

Work has commenced on planning tests of refrigerator doors to determine temperatures on inner and outer surfaces and around the gasket

construction. Panel frames have been designed in which the door test specimens can be mounted for insertion into a panel warehouse. Plans have also been drawn up for the refrigerating units required to produce the low temperature conditions within the warehouse.